8 The variables x and y satisfy the differential equation

$$\left(x^2+1\right)\frac{\mathrm{d}y}{\mathrm{d}x} = kx\mathrm{e}^{2y},$$

where k is a constant. It is given that $y = 0$ when $x = 0$ and that $y = -\frac{1}{2}$ when $x = 1$.

Solve the differential equation and find the exact value of y when $x = \sqrt{3}$. [8]